

## **DYNAMIC PILE MONITORING**

Effective: February 5, 2009

Revised: January 15, 2010

**General.** This work consists of accommodating the dynamic monitoring of a pile at the substructure(s) indicated on the plans, both during their initial driving process and the re-strike procedure conducted after the minimum waiting period specified herein has elapsed. All pile driving operations shall follow Section 512 of the standard specifications unless otherwise indicated in this special provision.

Dynamic monitoring will be accomplished by attaching sensors near the top of the pile which transmit data by cable or wireless connection to a Pile Driving Analyzer (PDA) unit at the site. The sensors, their attachment to the pile, the connection to PDA, and the operation of the PDA will be provided by Dr Jim Long or another PDA operator from the University of Illinois Urbana Champaign (UIUC).

Unless otherwise approved by the Engineer and agreed to by Dr. Long, the pile to be monitored at the specified substructure(s) shall be the test pile. When no test pile is provided at the specified substructure, the first production pile driven at the substructure shall be the dynamically monitored pile.

**Submittals.** The Contractor shall submit a completed "Pile Driving Equipment Data" Form (<http://www.dot.il.gov/Forms/BBS%20136.docx>) included below to the Engineer for transmittal by email to Dr. Long at ([jhlong@uiuc.edu](mailto:jhlong@uiuc.edu)) to prepare the PDA. The Contractor shall also notify the Engineer in writing of the anticipated driving and re-strike date(s) of the pile(s) to be dynamically monitored to allow the Engineer to inform Dr. Long at (217-333-2543) of the schedule. Both the completed form and written driving and re-strike dates shall be provided to the Engineer and sent to Dr. Long a minimum of two weeks prior to driving the first dynamically monitored pile. Any changes to the proposed driving equipment or dates shall be submitted to the Engineer to determine if they can be accommodated by Dr. Long or another PDA operator.

### **Construction.**

Dynamic monitoring will be performed during the final 20 to 50 ft (6 to 15 m) of initial driving. Depending on the location of any contractor planned pile splices and the total estimated pile length, the PDA operator will determine if all pile segments or only selected pile segments will require monitoring. After lifting the section(s) of the pile to be monitored into the leads, the Contractor shall provide labor to access to either side of the H-pile web or the Metal Shell within the top 8 ft (2.4 m) while in the leads to attach the sensors which should take less than 10 minutes.

When the level of the sensors is within 1 ft (300 mm) of any obstruction endangering the survival of sensors and/or cables, driving shall be halted and the contractor shall remove the sensors and reattach them after passing the obstruction. When sensors are within 1 ft (300 mm) of the ground surface, driving shall be halted and the contractor shall remove the sensors and reattach them near the top of the next pile segment after lifting into place and splicing.

The driving will be terminated when the Nominal Driven Bearing exceeds the Nominal Required Bearing shown on the plans by no more than 20 percent as directed by the Engineer per PDA operator's analysis. Upon completion of initial driving process of each dynamically monitored pile, the Contractor shall provide the PDA operator access to remove the sensors. Other piles in the substructure and elsewhere on the project may be driven during the waiting period but the dynamically monitored piles shall not be cut off and remain accessible for the re-strike procedure.

If the sensors are located 10 ft (3 m) or more above the ground at the end of initial driving, the Contractor shall provide equipment and labor to remove the sensors as well as reattach them after the waiting period, just prior to the re-strike procedure.

Unless otherwise specified on the plans, the Contractor shall wait a minimum of 15 days prior to re-striking piles.

After the minimum waiting period has elapsed, the Contractor shall warm up the hammer by driving another pile a minimum of an additional 20 blows and reposition the driving equipment on the re-strike pile. Once the PDA operator has reattached the sensors and connections, the contractor shall apply at least 20 blows or drive the pile an additional 3 in (75 mm), whichever occurs first to allow the PDA to obtain the final pile setup data. The contractor shall remove and provide the sensors to the PDA operator after which the contractor may proceed with cutting the pile to length and normal construction.

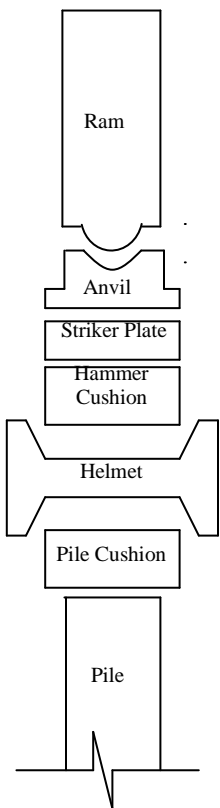
**Method of Measurement and Basis of Payment.** This work will not be measured for payment but shall be included in the appropriate pay item(s) for Test Piles and Driving piles.



# Illinois Department of Transportation

## Pile Driving Equipment Data

Structure Number: \_\_\_\_\_  
Pile Driving Contractor: \_\_\_\_\_  
Abutment /Pier Number(s): \_\_\_\_\_ Route: \_\_\_\_\_  
Pile Type & Size(s): \_\_\_\_\_ Section: \_\_\_\_\_  
Nominal Required: \_\_\_\_\_ County: \_\_\_\_\_  
Production Pile Length(s): \_\_\_\_\_ Closest Boring(s): \_\_\_\_\_ Contract: \_\_\_\_\_  
Hammer Manufacturer: \_\_\_\_\_ Model No: \_\_\_\_\_  
Type (diesel, air/steam hydraulic, etc.): \_\_\_\_\_ Ram Stroke Type (fixed or Variable): \_\_\_\_\_  
Maximum Operating Energy: \_\_\_\_\_ Minimum Operating Energy: \_\_\_\_\_



Maximum Recommended Stroke: \_\_\_\_\_  
Minimum Measurable Stroke: \_\_\_\_\_  
Ram Weight: \_\_\_\_\_  
Anvil Weight: \_\_\_\_\_  
Modifications to Hammer (if any): \_\_\_\_\_  
Striker Plate  
Diameter: \_\_\_\_\_  
Thickness: \_\_\_\_\_  
Weight: \_\_\_\_\_  
Hammer Cushion Material 1  
Material Type: \_\_\_\_\_  
Diameter: \_\_\_\_\_  
Thickness per Plate: \_\_\_\_\_  
No. of Plates: \_\_\_\_\_  
Total Hammer Cushion Thickness: \_\_\_\_\_  
Hammer Cushion Material 2 (if composite)  
Material Type: \_\_\_\_\_  
Diameter: \_\_\_\_\_  
Thickness per Plate: \_\_\_\_\_  
No. of Plates: \_\_\_\_\_  
Helmet (Drive Head, Pile Cap) Weight (including bonnet insert if any): \_\_\_\_\_  
Pile Cushion (precast concrete piles only)  
Material: \_\_\_\_\_  
Thickness Per Sheet: \_\_\_\_\_  
Area: \_\_\_\_\_  
No. of Sheets: \_\_\_\_\_  
Thickness Total: \_\_\_\_\_

Double Acting/Differential Acting Air or Steam

Hammers Net Weight: \_\_\_\_\_  
Cylinder Net Weight: \_\_\_\_\_  
Piston Area: \_\_\_\_\_

Attach Bounce Chamber Pressure vs. Equivalent Energy Graphs (Closed-End Diesel Hammers Only): \_\_\_\_\_

Hammer Data Completed by: \_\_\_\_\_ Contact Phone Number: \_\_\_\_\_  
Date Completed: \_\_\_\_\_